

Jun 27th, 2:10 PM - 2:30 PM

## Concurrent Sessions D: Designing Roughened Channels for Fish Passage - Roughened Channel Design - The WDFW Perspective

Bruce Heiner  
WDFW

Follow this and additional works at: [https://scholarworks.umass.edu/fishpassage\\_conference](https://scholarworks.umass.edu/fishpassage_conference)

---

Heiner, Bruce, "Concurrent Sessions D: Designing Roughened Channels for Fish Passage - Roughened Channel Design - The WDFW Perspective" (2013). *International Conference on Engineering and Ecohydrology for Fish Passage*. 50.  
[https://scholarworks.umass.edu/fishpassage\\_conference/2013/June27/50](https://scholarworks.umass.edu/fishpassage_conference/2013/June27/50)

This Event is brought to you for free and open access by the Fish Passage Community at UMass Amherst at ScholarWorks@UMass Amherst. It has been accepted for inclusion in International Conference on Engineering and Ecohydrology for Fish Passage by an authorized administrator of ScholarWorks@UMass Amherst. For more information, please contact [scholarworks@library.umass.edu](mailto:scholarworks@library.umass.edu).

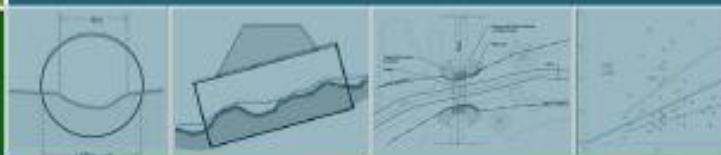
# Roughened Channels in Washington State

Bruce Heiner, P.E.





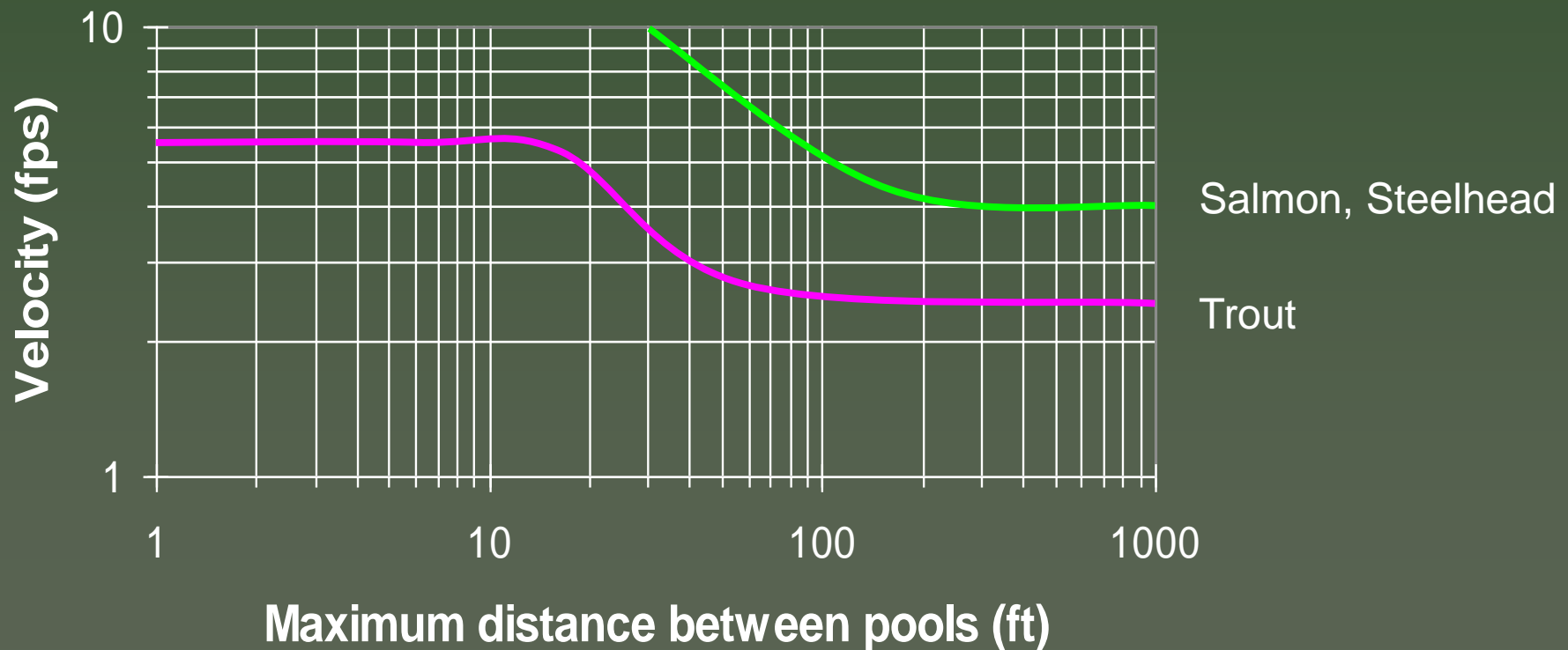
2013



## Water Crossing Design Guidelines

Washington Dept. of Fish and Wildlife

# Swimming Abilities of Salmon and Trout



From Evans and Johnston (1980), developed by Ziemer, ADFW







# Stream Simulation Design



Club Ck.

Width =  $1.2W_{ch} + 2$  ft

Slope = 6.8%

# Stream Simulation Criteria

- Streambed width inside the culvert  
 $\geq (1.2 \times \text{BFW}) + 2\text{ft.}$
- Slope Ratio ( culvert slope/channel slope)  
 $< 1.25$

# WDFW Water Crossing Guidelines

\$200

# WDFW Water Crossing Guidelines

A hydraulic design method to create a stable channel that has a slope ratio greater than 1.25 or a streambed width less than  $(1.2 \times \text{BFW}) + 2 \text{ ft.}$











# Coal Ck.

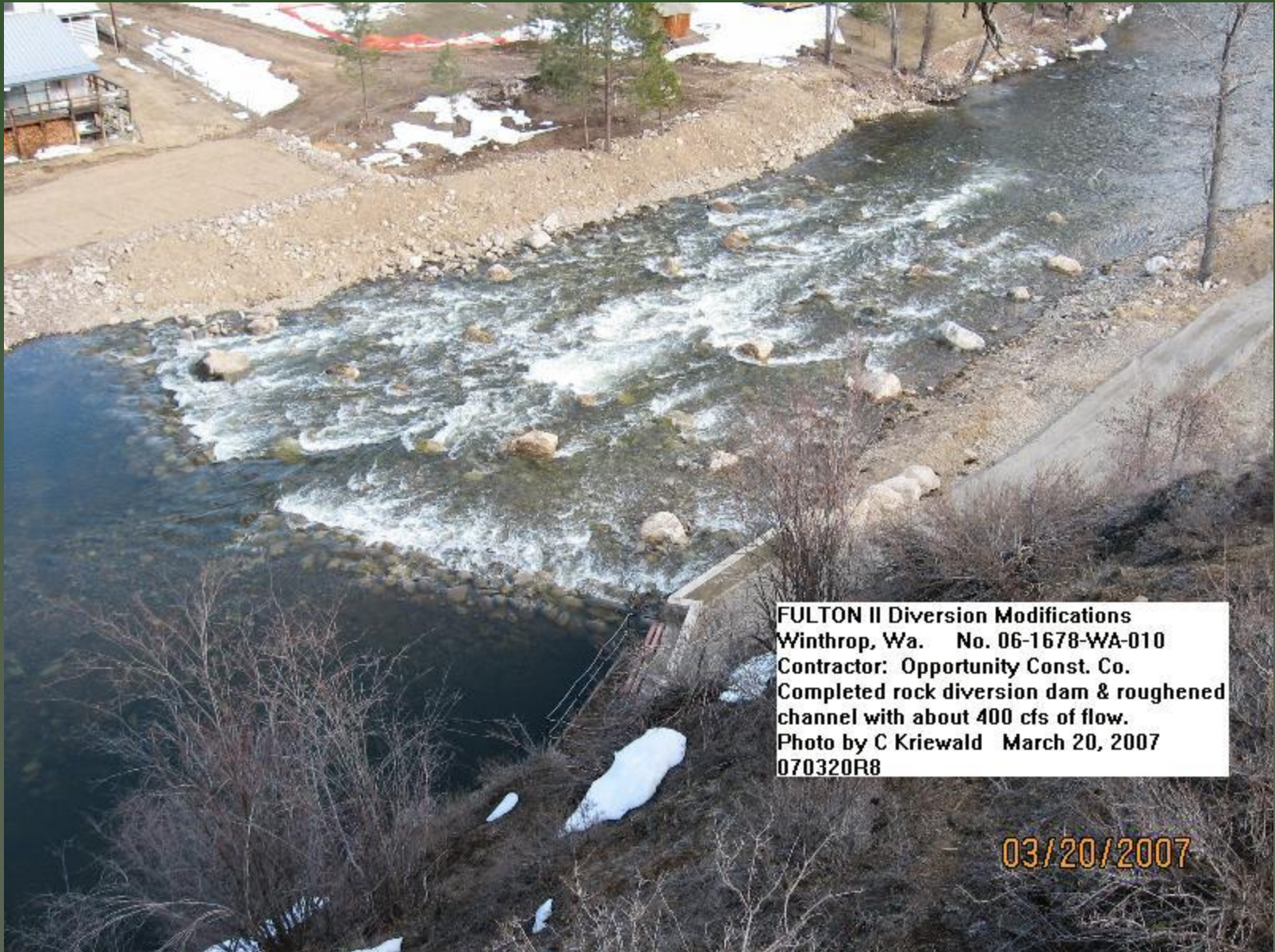
Roughened channel

Width ratio = 0.57

Slope = 5%







**FULTON II Diversion Modifications**  
**Winthrop, Wa. No. 06-1678-WA-010**  
**Contractor: Opportunity Const. Co.**  
**Completed rock diversion dam & roughened**  
**channel with about 400 cfs of flow.**  
**Photo by C Kriewald March 20, 2007**  
**070320R8**

03/20/2007

















Roughened channel  
used for grade control  
below an existing  
culvert.





# Dickerson Creek jacked pipe with baffles

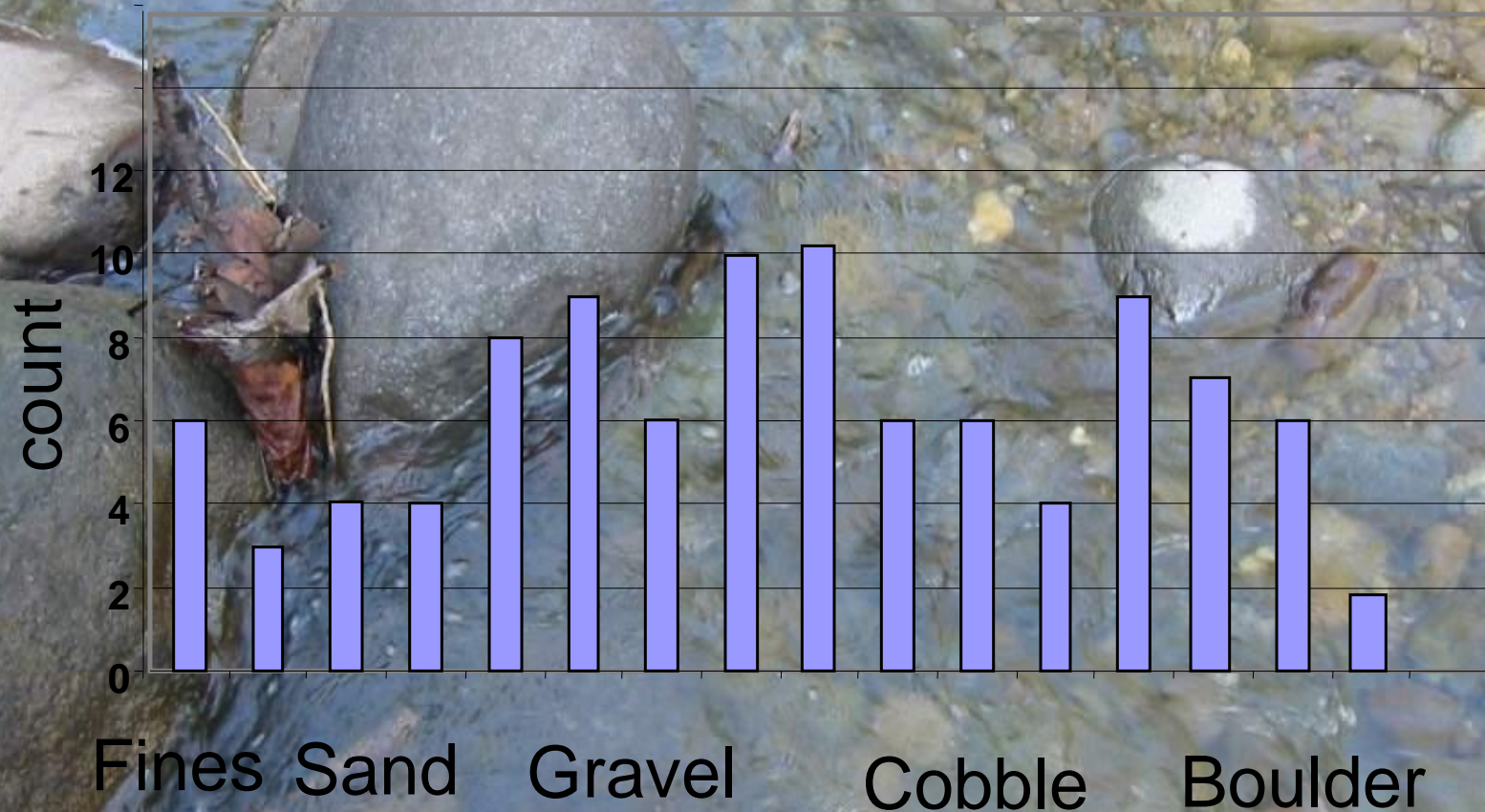


# Roughened Channel Design Steps

1. Assume a channel span and shape.
2. Size bed material for stability at peak flow.
3. Check largest bed particle diameter is less than  $\frac{1}{4}$  the channel span.
4. Create a bed gradation to control porosity.
5. Calculate average velocity and check turbulence at high fish passage flow.
6. Check culvert size for peak flood capacity.



# Well-graded Bed Material





# Fulton Irrigation Diversion, Chewuch River





An aerial photograph showing a river diversion dam. The dam is a long, low structure with a rough, rocky surface, creating a series of rapids and white water. The river flows from the top right towards the bottom left. The surrounding landscape is a mix of brown earth, snow patches, and some trees. A concrete structure is visible at the bottom of the dam.

210 ft long, 5% slope,  
Toe width 105 – 75 ft

**FULTON II Diversion Modifications**  
Winthrop, Wa. No. 06-1678-WA-010  
Contractor: Opportunity Const. Co.  
Completed rock diversion dam & roughened  
channel with about 400 cfs of flow.  
Photo by C Kriewald March 20, 2007  
070320R8

03/20/2007























# Chewuch River, Winthrop WA



Old Chewuch Diversion @ 45 cfs



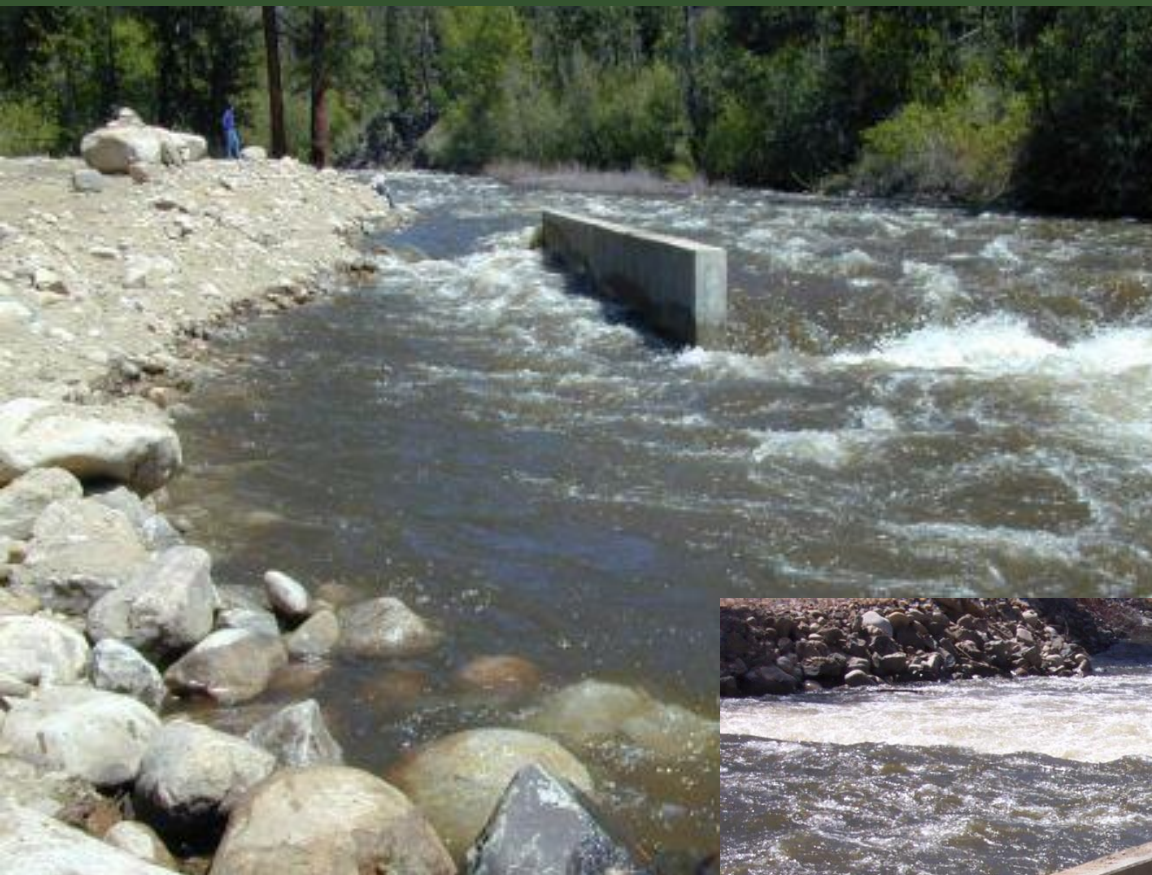
## New Chewuch diversion roughened channel



60 ft long, 6.3% slope,  
10 ft toe width







2400 cfs



1650 cfs

















# Curl Lake Acclimation Diversion Weir Tucannon River





60 ft long, 3.75% slope, 20 ft toe width







D100 = 4.5 ft.











